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EXAMINER	
KIM, CHONG R	

ART UNIT	PAPER NUMBER
2623	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/883,945	Applicant(s) SAWA ET AL.	
	Examiner Charles Kim	Art Unit 2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-29 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-10,13-22 and 25-29 is/are rejected.

7)☒ Claim(s) 11,12,23 and 24 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 29 October 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 8.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

1. Claims 2, 4, 5, 6, 14, 16, 17, 18, 26, 27, 28, 29 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Referring to claim 2, the phrase "varying a threshold value used in the first step when the edge points are detected as sub-pixels" in lines 7-9 is not sufficiently supported by the applicant's specification. More specifically, the applicant's specification is non-enabling in regards to how the edge direction of the reference pattern is recognized (first step) using a threshold value. It appears that the applicant intended the phrase to read "varying a threshold value used in the second step when the edge points are detected as sub-pixels", as supported in lines 23-26 on page 37 of the applicant's specification. A similar rejection is also applicable to claim 14.

Referring to claim 4, the phrase "recognizing a pair when templates of edge direction patterns show that the edge directions oppose each other" in lines 11-13 is not sufficiently

supported by the applicant's specification. More specifically, the applicant's specification is non-enabling in regards to how the pair is recognized when the edge patterns show that the edge directions oppose each other. In view of the applicant's specification, it appears that the edge directions of the edge pairs are parallel with each other. For example, in figure 7, the edge pairs G1 and G2 both have vertical edge directions. Therefore, the applicant's specification is non-enabling in regards to "recognizing a pair when templates of edge direction patterns show that the edge directions oppose each other". Similar rejections are applicable to claims 5, 6, 16, 17, 18, 27, 28, 29.

Referring to claim 26, the phrase "varying a threshold value based on which the edge points are detected as the sub-pixels in said fourth step" in lines 7-9 is not sufficiently supported by the applicant's specification. More specifically, the applicant's specification is non-enabling in regards to how the edge direction of the reference pattern is recognized (fourth step) using a threshold value. It appears that the applicant intended the phrase to read "varying a threshold value based on which the edge points are detected as the sub-pixels in said fifth step", as supported in lines 23-26 on page 37 of the applicant's specification.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-12, 16-18, 24, 27-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Referring to claim 1, the phrase "calculating a widthwise dimension of the pattern under

inspection, from edge portions located at the same position as the edge portion whose widthwise dimension is calculated by use of the reference pattern" in lines 13-17 lacks antecedent basis. More specifically, the claim does not recite the step of calculating the widthwise dimension of the reference pattern based on the edge portions prior to calculating the widthwise dimension of the pattern under inspection.

Referring to claim 4, the phrase "recognizing a pair" in line 11 renders the claim indefinite because it is unclear what the "pair" is referring to. It appears that the applicant intended the phrase to read "recognizing an edge pair". Similar rejections are applicable to claims 5, 6, 16, 17, 18, 27, 28, 29. Appropriate correction is required.

Referring to claim 12, the phrase "calculating a widthwise dimension of the reference pattern at the same position as a pair of pixels whose widthwise dimension is calculated by use of the reference pattern" in lines 31-34 renders the claim indefinite because it is unclear what is being claimed. It appears that the applicant intended the phrase to read "calculating a widthwise dimension of the pattern under inspection at the same position as a pair of pixels whose widthwise dimension is calculated by use of the reference pattern". Appropriate correction is required.

Referring to claim 24, the phrase "the pattern under inspection" in line 36 lacks antecedent basis. It appears that the applicant intended the phrase to read "a pattern under inspection". Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 3, 8-10, 13, 15, 20-22, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Greenberg et al., U.S. Patent No. 6,072,897 ("Greenberg").

Referring to claim 1 as best understood, Greenberg discloses a size checking method comprising:

a. a first step of reading image data on a reference pattern (col. 7, lines 18-22) and recognizing an edge direction (angle) of the reference pattern on the basis of pixel values detected at edge portions which are end portions as viewed in the width direction of the reference pattern (col. 8, lines 19-21 and col. 13, lines 48-59)

b. a second step of detecting edge points corresponding to the end portions as sub-pixels on the basis of the pixel values detected at the edge portions [col. 13, lines 48-61 and col. 14, lines 25-38. Note that the step of determining the location of the opening and closing edge within a pixel (col. 14, lines 33-34) is interpreted as being analogous to detecting the edge points as sub-pixels]

c. a third step of acquiring image data on a pattern under inspection (col. 7, lines 18-22)

d. a fourth step of reading the image data on the pattern under inspection and calculating a widthwise dimension of the pattern under inspection, from edge portions (col. 14, lines 31-38 and col. 15, lines 13-33)

e. a fifth step of determining whether or not the pattern under inspection is defective on the basis of the widthwise dimension of the reference pattern and the widthwise dimension of the pattern under inspection (col. 16, lines 20-65).

Greenberg does not explicitly disclose that the widthwise dimension of the pattern under inspection is calculated from the edge portions located at the same position as the edge portion whose widthwise dimension is calculated by use of the reference pattern. However, the Examiner notes that this would have been an obvious feature in Greenberg for at least the following reasons. Greenberg is concerned with comparing two patterns based on the widthwise dimensions of each pattern. Note that in order for the comparison to be properly made, the widthwise dimensions from each pattern have to be from corresponding locations. For example, registration is a common technique used to ensure that the measurements are from corresponding locations. Also, if two identical non-symmetric patterns were compared based on the widthwise dimensions in each pattern, and the widthwise dimensions were not from corresponding locations, then the comparison process would produce erroneous results. Therefore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to determine the widthwise dimension of the pattern under inspection, from the edge portions located at the same position as the edge portion whose widthwise dimension is calculated by use of the reference pattern. The suggestion/motivation for doing so would have been to enhance the defect inspection process by performing a proper comparison between the two patterns.

Referring to claim 3, Greenberg further discloses that the image data on the reference pattern is acquired by performing an operation on the basis of design data on the semiconductor wafer circuit pattern (col. 6, lines 35-54).

Referring to claim 8, Greenberg further discloses that the pattern under inspection is a semiconductor wafer circuit pattern formed on a mask used in exposure processing (col. 6, lines 35-54).

Referring to claim 9, Greenberg further discloses that the fourth step includes detecting edge portions which are end portions as viewed the width direction of the pattern under inspection (col. 13, lines 48-61 and col. 14, lines 25-31), and calculating the widthwise dimension of the pattern under inspection, with the edge points as starting points (opening edge) [col. 14, lines 31-35].

Greenberg does not explicitly disclose that the edge points are detected with respect to the edge portions located at the same position as the edge portions whose widthwise dimension is calculated by use of the reference pattern. However, this would have been an obvious feature in Greenberg, for the reasons stated above (claim 1).

Referring to claim 10, Greenberg further discloses that the fifth step includes calculating a dimensional error on the basis of the difference between the widthwise dimension of the pattern under inspection and the widthwise dimension of the reference pattern, and determining an abnormal state when a value obtained by adding an offset value to the dimensional error is out of an allowable range (threshold) [col. 2, lines 55-63 and col. 16, lines 20-65].

Referring to claim 13, Greenberg discloses a size checking apparatus comprising:

a. pattern recognition means (51-52) for reading image data on a reference pattern (col. 7, lines 18-22) and recognizing an edge direction (angle) of the reference pattern on the basis of pixel values detected at edge portions which are end portions as viewed in the width direction of the reference pattern (col. 8, lines 19-21 and col. 13, lines 48-59)

b. first size measuring means (53) for detecting edge points corresponding to the end portions as sub-pixels on the basis of the pixel values detected at the edge portions [col. 13, lines 48-61 and col. 14, lines 25-38. Note that the step of determining the location of the opening and closing edge within a pixel (col. 14, lines 33-34) is interpreted as being analogous to detecting the edge points as sub-pixels], and for calculating a widthwise dimension of the reference pattern, from the edge points as starting points (col. 14, lines 31-38)

c. means (41-42) for acquiring image data on a pattern under inspection (col. 7, lines 18-22)

d. second size-measuring means (43) for reading the image data on the pattern under inspection and calculating a widthwise dimension of the pattern under inspection, from edge portions (col. 14, lines 31-38 and col. 15, lines 13-33)

e. means (60) for determining whether or not the pattern under inspection is defective on the basis of the widthwise dimension of the reference pattern and the widthwise dimension of the pattern under inspection (col. 16, lines 20-65).

Greenberg does not explicitly disclose that the widthwise dimension of the pattern under inspection is calculated from the edge portions located at the same position as the edge portion whose widthwise dimension is calculated by use of the reference pattern. However, the Examiner notes that this would have been an obvious feature in Greenberg for at least the

following reasons. Greenberg is concerned with comparing two patterns based on the widthwise dimensions of each pattern. Note that in order for the comparison to be properly made, the widthwise dimensions from each pattern have to be from corresponding locations. For example, registration is a common technique used to ensure that the measurements are from corresponding locations. Also, if two identical non-symmetric patterns were compared based on the widthwise dimensions in each pattern, and the widthwise dimensions were not from corresponding locations, then the comparison process would produce erroneous results. Therefore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to determine the widthwise dimension of the pattern under inspection, from the edge portions located at the same position as the edge portion whose widthwise dimension is calculated by use of the reference pattern. The suggestion/motivation for doing so would have been to enhance the defect inspection process by performing a proper comparison between the two patterns.

Referring to claim 15, see the rejection of at least claim 3 above.

Referring to claim 20, see the rejection of at least claim 8 above.

Referring to claim 21, Greenberg further discloses an exposure apparatus having a mask on which a semiconductor wafer circuit pattern is formed, imaging means for imaging a mask image projected by the exposure apparatus, and image processing means for deriving image data from image signals output from the imaging means (col. 6, lines 25-46).

Referring to claim 22, see the rejection of at least claim 10 above.

Referring to claim 25, Greenberg discloses a mask manufacturing method comprising:

a. a first step of preparing a mask having a base plate on which a circuit pattern of a semiconductor device is formed (col. 6, lines 25-46)

b. a second step of preparing first image data on a reference pattern, on the basis of design data on the circuit pattern of the semiconductor device (col. 7, lines 18-22)

c. a third step of preparing second image data on the circuit pattern by projecting light on the mask and acquiring a projected image of the mask (col. 7, lines 18-22)

d. a fourth step of reading image data on a reference pattern (col. 7, lines 18-22) and recognizing an edge direction (angle) of the reference pattern on the basis of pixel values detected at edge portions which are end portions as viewed in the width direction of the reference pattern (col. 8, lines 19-21 and col. 13, lines 48-59)

e. a fifth step of detecting edge points corresponding to the end portions as sub-pixels on the basis of the pixel values detected at the edge portions [col. 13, lines 48-61 and col. 14, lines 25-38. Note that the step of determining the location of the opening and closing edge within a pixel (col. 14, lines 33-34) is interpreted as being analogous to detecting the edge points as sub-pixels], and for calculating a widthwise dimension of the reference pattern, from the edge points as starting points (col. 14, lines 31-38)

f. a sixth step of reading the image data on the circuit pattern and calculating a widthwise dimension of the circuit pattern, from edge portions (col. 14, lines 31-38 and col. 15, lines 13-33)

g. a seventh step of determining whether or not the circuit pattern is defective on the basis of the widthwise dimension of the reference pattern and the widthwise dimension of the circuit pattern (col. 16, lines 20-65).

Greenberg does not explicitly disclose that the widthwise dimension of the circuit pattern is calculated from the edge portions located at the same position as the edge portion whose

widthwise dimension is calculated by use of the reference pattern. However, the Examiner notes that this would have been an obvious feature in Greenberg for at least the following reasons. Greenberg is concerned with comparing two patterns based on the widthwise dimensions of each pattern. Note that in order for the comparison to be properly made, the widthwise dimensions from each pattern have to be from corresponding locations. For example, registration is a common technique used to ensure that the measurements are from corresponding locations. Also, if two identical non-symmetric patterns were compared based on the widthwise dimensions in each pattern, and the widthwise dimensions were not from corresponding locations, then the comparison process would produce erroneous results. Therefore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to determine the widthwise dimension of the circuit pattern, from the edge portions located at the same position as the edge portion whose widthwise dimension is calculated by use of the reference pattern. The suggestion/motivation for doing so would have been to enhance the defect inspection process by performing a proper comparison between the two patterns.

4. Claims 7, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Greenberg et al., U.S. Patent No. 6,072,897 ("Greenberg") and Kanebako et al., U.S. Patent No. 5,680,471 ("Kanebako").

Referring to claim 7, Greenberg does not explicitly disclose that the second step of detecting edge points includes preparing a profile showing how pixel values are distributed in the width direction of the reference pattern, the pixel values corresponding to the edge portion whose

edge direction is recognized, and detecting edge points as sub-pixels using a predetermined threshold value with respect to the profile.

Kanebako discloses a method for detecting edge points that includes preparing a (long axis perpendicular) profile showing how pixel values are distributed in the width direction of the reference pattern (col. 10, lines 37-45 and figure 4), and detecting edge points using a predetermined threshold value with respect to the profile (col. 10, lines 45-50, col. 11, lines 4-10 and figure 6).

Greenberg and Kanebako are combinable because they are both concerned detecting edge points based on image processing methods. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the second step of Greenberg to include the steps of Kanebako. The suggestion/motivation for doing so would have been to enhance the edge detection step by automatically extracting the edge portions with a reduced number of operations (Kanebako, col. 7, lines 6-13). Therefore, it would have been obvious to combine Greenberg with Kanebako to obtain the invention as specified in claim 7.

Referring to claim 19, see the rejection of at least claim 7 above.

Allowable Subject Matter

5. Claims 11, 12, 24 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

6. Claim 23 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Mita et al. U.S. Patent No. 4,392,120 discloses a method for checking a size of a pattern that includes the steps of determining an edge direction and a width dimension of a pattern under inspection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Charles Kim whose telephone number is 703-306-4038. The examiner can normally be reached on Mon thru Thurs 8:30am to 6pm and alternating Fri 9:30am to 6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 703-308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ck
July 12, 2004

Jon Chang
Primary Examiner